

# Asymmetric Information Mitigation in Supply Chain: A Systematic Literature Review

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**Abstract**— With the level of competition and consumer demand is changing rapidly, the speed and accuracy of the information flow in the supply chain increasingly necessary. Sharing of information between the parties in a supply chain plays an important role in improving the sustainability of a business, but imperfection information is inevitable because each party in the supply chain has a different objective. This condition increases the importance of a research on the mitigation of asymmetric information in supply chain, therefore the purpose of this study was to conduct a review of previous studies related to overcoming the asymmetric information and map research trend on mitigating asymmetric information in the supply chain. We used systematic literature review (SLR) methods to analyze the data collected from Web of Science and Scopus database from 2005 to 2016. The results of this study can be used as a guide and a reference for further research related to overcoming the asymmetry of information in the supply chain in every industrial sector.

**Keywords:** Supply chain, asymmetric information, sharing information, systematic literature review

## 1. Introduction

The role of the supply chain in the success of a business becomes significantly greater than before, the collaboration between parties intra and inter sectors is one of the keys to the sustainability of a business's performance. In supply chain that consists of many independent actors, there is a higher chance of conflict because each entity in supply chain has a different purpose. Formulate better hierarchy of supply chain can diminish the potential of conflict that may occurred [15], since with only a single disruption can caused huge problem on supply chain flow.

Along with the development of technology and information (IT), the faster exchange of information becomes makes the distance and time factors are no longer a limitation. This development has a positive impact to the network, connectivity and development on intra and inter-business which has

become infinite [9]. In addition, the globalization can also increase the business competitiveness that makes the coordination between parties involved in a business becomes very crucial. Although, globalization might increase the risk of supply in term on business capability on provide better supply and meet sufficient demand because of dependencies [10].

Information sharing is crucial to business sustainability as it signaled there is a trust among all actors involved in the supply chain, where interpersonal relationship and the involvement of government can help to increase the level of trust among members in supply chain, which can boost the flow of information sharing [8]. The advantages of sharing information in the supply chain in addition to increasing trust among supply chain member are reducing the cost of acquiring and managing the information [4]. Information sharing among all parties in the supply chain will likely to diminish the likelihood of "Bullwhip Effect" [5]. However, not all types of businesses can easily share their information, for instance, small and medium enterprises (SMEs) [6].

Collaboration and integration between stakeholders in the supply chain can strengthen the network and improve services to consumer because information related to products and services can be channel properly from upstream to downstream. Nevertheless, the resistant among supply chain managers to willingly share their information still exist [3]. To meet all demand and able to compete in rapidly change business environment each party has to collaborate to form and join integrated supply chain [2]. Although, previous study showed that there are many factors that trigger company to form supply chain collaboration, from markets, products and characteristic of potential supply chain partner [12].

Form of collaboration can varies from merely transaction partner to deep relation but can also

from simple communication to supplier development [13]-[14]. In addition, previous studies have suggested factors that drive each party to coordinate in the supply chain (seller-buyer relation) were flexibility and discount in quantity of the product [11]. The study of supply chains has become increasingly complex in the last decade, the supply chain is associated with different parts, functions, and operations in different industries which is related to coordination and cooperation. By collaboration among member of supply chain can significantly build the firm performance [7], although, in practice, asymmetric information in the supply chain still occurred even in long established collaboration and yet still one of the main issue to overcome.

Given the complexity of the supply chain and the different goals of each of the parties in the supply chain, several questions arise regarding the research on how to overcome the asymmetric information in the supply chain. Some of the objectives of a literature-based research study are to analyze the evolution of a research topic [96], to identify gap and provide framework [97]. Thus in this paper, we would like to review a research trend with asymmetric information mitigation topics in the supply chain over the last decade and to answer the questions in this study. Start with, is there a link between the types of business sectors with the possibility of asymmetric information in the supply chain? What is an effective method for addressing asymmetric information?; Does the echelon hierarchy in the supply chain also give effect to the possibility of asymmetric supply chain information?; Finally, what factors are the main cause of asymmetric information?. For that reason, we use

Systematic Literature Review (SLR) to map out the emerging questions and review the research trends related to the effort to overcome the asymmetric information in the supply chain. Furthermore, in this paper will be divided as follows, the research method will be discussed in the second part, then in the third part we will describe and discuss the results of the study and the fourth part is the conclusions and implications in further research.

## 2. Methodology

Systematic review literature (SLR) emerged as one of the most widely used methods of conducting evidence-based research. SLR is the expanded version of stand-alone literature review study [16], where SLR is a systematic, explicit, comprehensive and reproducible method to identifying, evaluating, and synthesizing previous study [17].

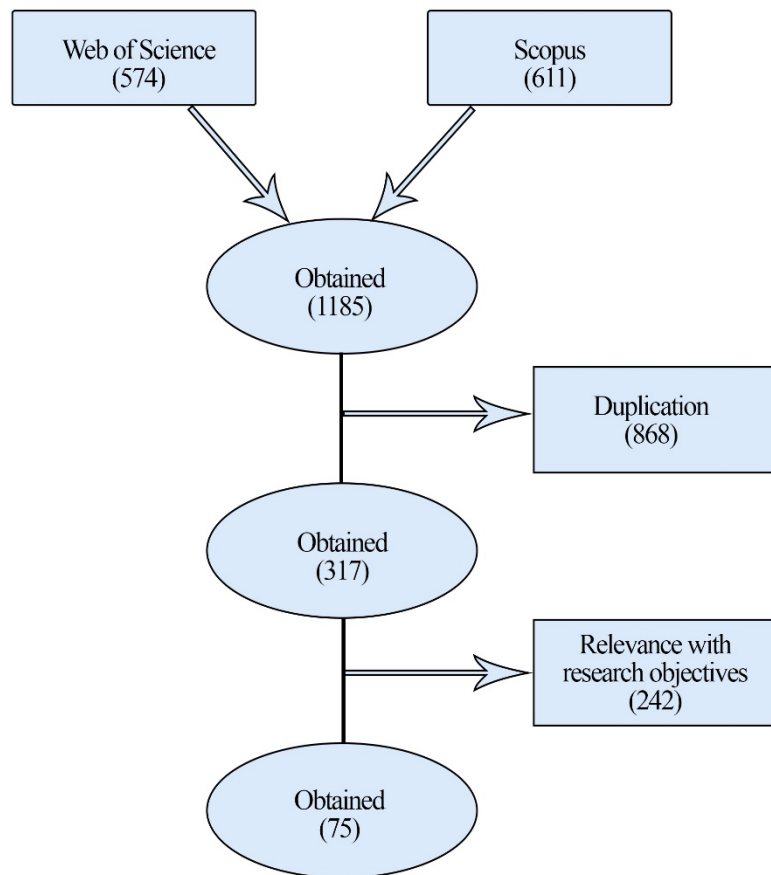
However, this method also has weaknesses, among others, overuse and underuse literature can cause same effect on the quality of the result [18]. In addition, the disadvantages of this method include the depth of the analysis, which according to [20] that review research is very limited in depth in the analysis and more likely to become qualitative descriptive approach.

### 2.1. Research Design

In this section, we will describe the design and implementation of systematic review literature (SLR) in this study. We use a concept developed by [16] on SLRs consisting of three-stage procedures: planning, selection, extraction and execution.

**Table 1.** Research Questions

ID	Question	Objective
RQ1	What type of echelon relationship levels in the supply chain most often occur asymmetry information in the supply chain?	To identify whether two-echelon or three-echelon relationships in a supply chain that are most asymmetry information in supply chain occur.
RQ2	What is the ratio of research focusing on non-agricultural and non-fishery sectors to agriculture and fisheries, asymmetric information in the supply chain related research's topic?	To identify previous research related to how to mitigate asymmetric information in supply chain mitigation based on business sector.
RQ3	What is the most commonly used research method for mitigation asymmetric information in the supply chain?	To identify the most commonly used method for asymmetric information mitigation in a supply chain.
RQ4	What is the main cause of asymmetric information in the supply chain?	To identify the factors that are the main problem of asymmetric information in the supply chain.



**Figure 1.** Article selection

Planning begins by determining the question of research that needs to be answered in this study (table 1), then on selection, we use two databases namely Scopus and Web of Knowledge. On extraction stage, we restricted searches to articles published from 2005 to 2016. We use four keywords to find related articles that are asymmetric information; asymmetric demand information; asymmetric supply chain; asymmetric information supply chain. The articles used are limited only to peer-reviewed articles because according to [19] are considered to have good and valid qualities and are more likely to have higher impact factors. Then stage 4 (execution) by writing the review report.

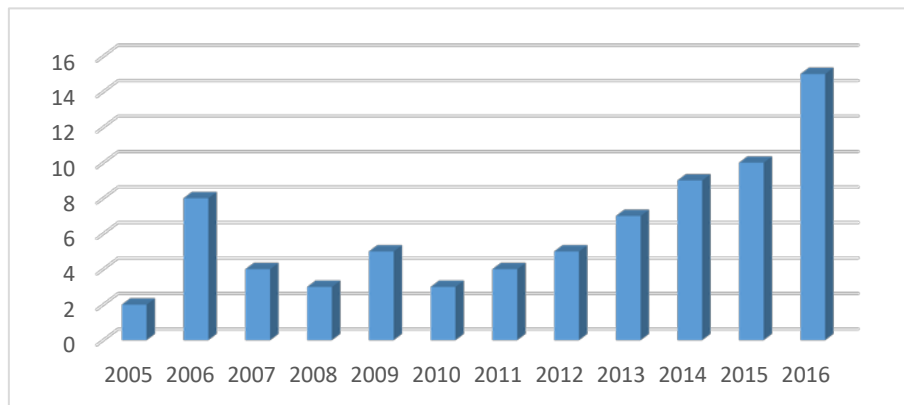
From search results with predefined keywords in two databases, we obtained a total of 574 articles from the web of science database and a total of 611 articles from Scopus database so that in total from two databases 1185 articles were obtained. Then we did a screening based on the duplication criteria between the two databases and we obtained 868 duplicate articles so the remaining articles were 317, then re-selected based on the relevance of the article

to the criteria of the question in the study (table 1). A total of 242 articles were excluded from the existing articles so that the number of articles used for the review process in this study was 75 articles (Figure 1).

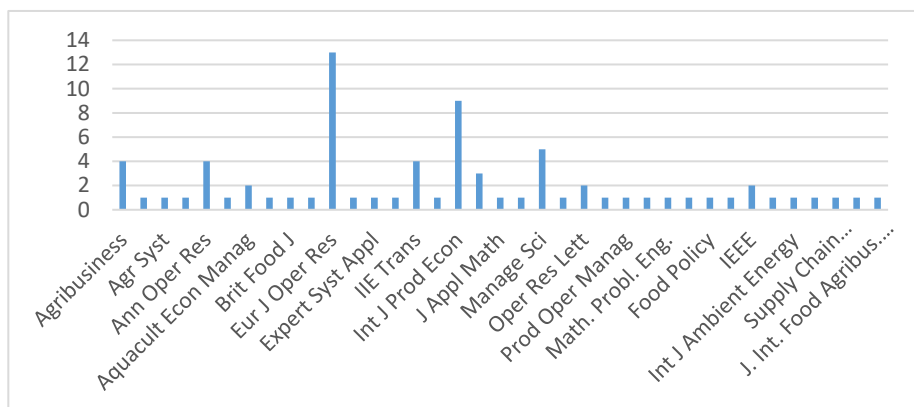
### 3. Result

#### 3.1. Descriptive analysis

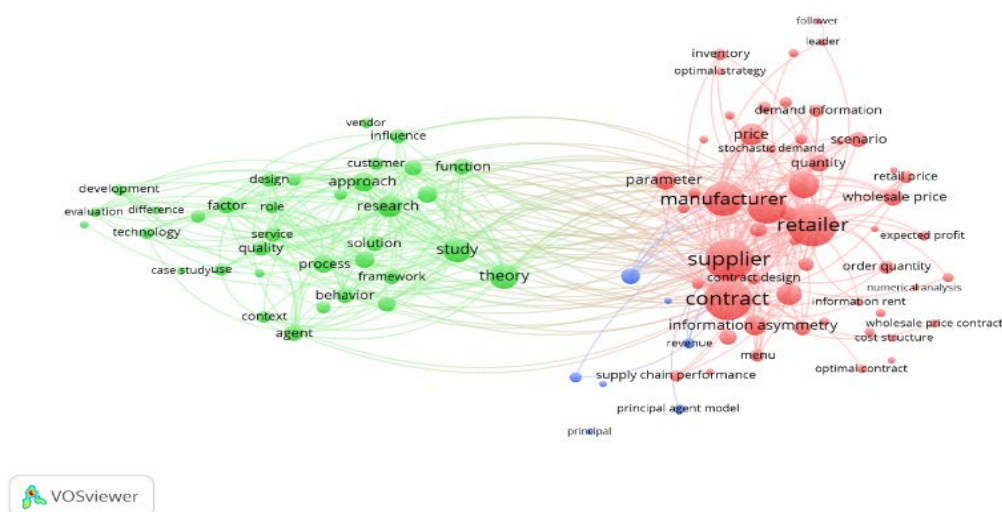
Descriptive analysis of the articles used in this study can be seen that most of the articles used in this study published in 2016, followed by scientific articles published in 2012 until 2015. This means that research trends associated with asymmetric topics information have been increasing since 2010 until now (Figure 2). Furthermore, most of the scientific articles published in the European Journal of Operational Research published by Elsevier and indexed on Web of Science (WoS) and Scopus are 13 articles, followed by International Journal of Production Economics which publishes 9 scientific articles and articles indexed in both Web of Science (WoS) and Scopus (Figure 3).



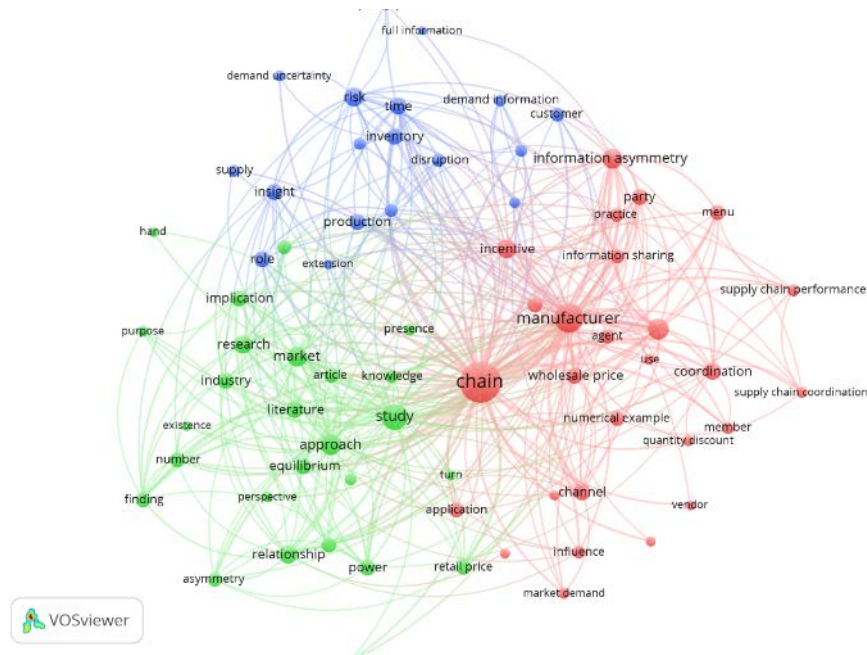
**Figure 2.** Research trend based on year of publication



**Figure 3.** Article based on publishing journal



**Figure 4a.** Bibliometric map Scopus-based database



Using the VOSviewer bibliometric networks application to map the topics covered in previous studies in two large databases of Web of Science and Scopus (Figures 4a and 4b), it can be seen that articles from the Web of Science and Scopus database are grouped into three clusters based on topics that appear in articles covering asymmetric information in supply chains published from 2005-2016.

In Figs. 4a and 4b, for articles published in the Web of Science and Scopus databases, resulted the first cluster is marked in red as a cluster that addresses the topics that are the main issues discussed in existing articles, including supply chain performance, wholesale price, information sharing, contracts, suppliers, manufacturers and information asymmetric. This indicates that the articles discussing the asymmetric information in the supply chain used in this study address many of the same topics, where coordination between companies and agents in the supply chain is a topic of considerable become the main concern over the past 10 years. In addition, the widely used method

is numerical simulation using the quantity discount and optimum supply chain coordination approach.

Furthermore, blue clusters are clusters that contain topics related to the causes of asymmetric information, which include inventory, time, disruption and principal agent theory. It appears that risk, time, inventory, disruption, demand information and customer are close together. This means that some of the causes of asymmetric information discussed by researchers over the last decade are risks arising from the limitation of information on the level of consumer demand, thus affecting storage time so that this condition will be related to the benefits gained by each party in the supply chain.

Then the green cluster is a cluster that contains topics related to the format and structure of writing, which includes the literature, study, approach, implication and purpose of the articles, which means that much technical writing uses literature approach related to real condition in each industry to build the structure of the implementation of the studies undertaken.

**Table 2.** Articles grouping based on the research questions

Group	Observed factor	Article
Cause of the asymmetric information in supply chain	Price	[21], [23]-[27], [36]-[40], [44]; [50]-[52], [54]-[55], [58]; [62]; [65]; [68]-[69]; [76]; [79]-[80], [91]
	Cost and quantity of production	[22]; [35]; [41]-[43]; [47]; [63]; [67]; [70]; [74]-[75]; [77]-[78]; [93]
	Demand	[30]; [45]-[46]; [48]-[49]; [64]; [66]; [73]; [83]; [86]
	Coordination on supply chain	[1]; [28]; [31]-[32]; [34]; [81]; [53]; [56]-[57]; [59]-[61]; [71]-[72]; [82]; [84]-[85]; [87]-[90]; [74]; [94]-[95]
Hierarchy relation on supply chain	Two echelons: Supplier/Retailer→Buyer Supplier→Retailer Manufacture→Supplier/Retailer	[1]; [21]-[27]; [30]; [32]-[36]; [38]-[41]; [43]-[52]; [55]-[57]; [59]; [61]-[65]; [67]-[68]; [70]-[74]; [76]-[79]; [83]-[90]; [92]-[93]; [95]
	Three echelons: Supplier→Retailer→Buyer	[31]; [37]; [42]; [53]-[54]; [58]; [60]; [66]; [69]; [75]; [80]; [82]; [91]; [94]
Business type	Non-agriculture and non-fisheries sector	[22]-[25]; [27]; [30]; [32]; [34]-[37]; [44]-[49]; [52]; [55]-[67]; [70]-[90]; [90]; [93]; [95]
	Agriculture and fishery sector	[1]; [21]; [26]; [28]; [31]; [38]-[40] [50]-[51]; [42]-[43]; [49]; [53]-[54]; [68]-[69]; [91]; [94]
Research Method used to analyze and mitigate asymmetric information in supply chain	Numerical analysis	[21]-[22]; [24]; [27]; [30]-[31]; [34]-[36]; [38]; [42]-[47]; [49]; [52]; [55]-[59]; [61]-[67]; [71]-[80]; [82]-[90]; [92]-[93]; [95]
	Fuzzy Approach	[23]; [32]; [81]; [60]; [70]; [79]
	Econometrics	[25]-[26]; [37]; [39]; [40]; [50]-[51]; [54]; [68]-[69]; [91]
	Literature Review	[1]
	Others	[28]; [41]; [53]; [94]



## 4. Discussion

In this section, we discuss the results of the answers to the questions in this study.

### 4.1. RQ1: Asymmetric information on type echelon relationship levels in the supply chain

In a supply chain, it generally consists of at least two levels of supply chain relationships, the relationship between farmers and retail, retail and suppliers or suppliers and manufacturers, each of which has the goal of maximizing profit. This condition will affect their behavior with related parties in the supply chain.

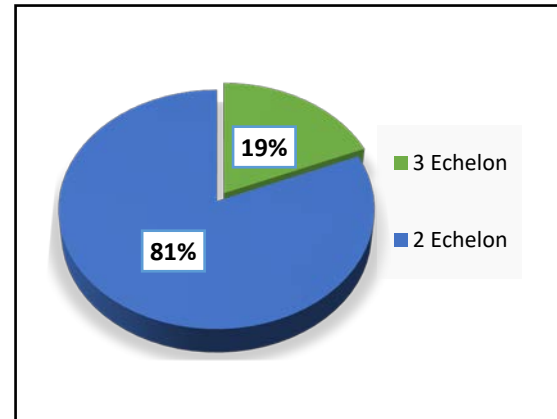
Different interests of each party in the supply chain can lead to distortions in the flow of information. Ref. [38] refers that in the relationship between farmers and retailers the opportunity for the asymmetric occurrence of the transmission of selling price occurs from farmers to retailers is significant, furthermore, they suggest that farmers forming oligopoly to improve the bargaining position of farmers. This condition will certainly force each party in the supply chain to issue a policy to counter each party policy to achieve the optimum profit that will cause complex problems in the future.

Then for a supply chain with three levels of echelons such as research conducted by [31] who saw the relationship between farmers, biomass companies and the government regarding the selling price set by the government to be paid by the company to farmers, indicating that the asymmetric that occurred can be overcome by the intervention of the party having a greater bargaining position which is the government by imposing a more objective policy structure. In another case, [53] analyzing the relationship between farmers, suppliers and consumers as buyers, they get the result that farmers need to increase their bargaining power by improving their innovation skills.

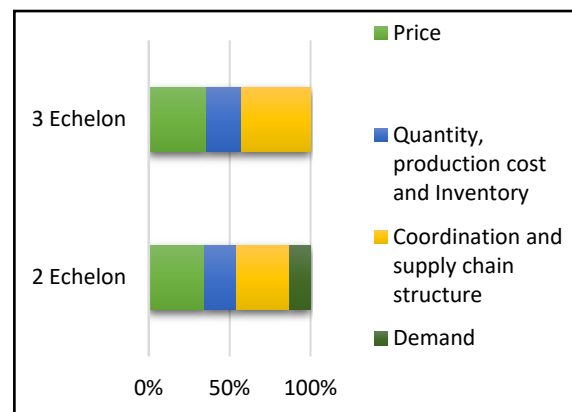
From the existing conditions indicates that the asymmetric information in supply chain caused by one party in the supply chain has a greater bargaining position than others so they have the ability to control the flow of information from upstream to the downstream supply chain.

The result of the literature study (Figure 5) shows that since 2005-2016 the problem of asymmetry information in the supply chain mostly occurred in the two-echelon supply chain. This also means that

during the last decade study asymmetric supply chain is still limited to the relationship between the two parties in the supply chain. Existing research uses an agent-based approach [28], [74] to analyze existing relationship patterns.



**Figure 5.** Mapping article based on echelon in supply chain



**Figure 6.** Relationship between echelon in supply chain with the cause of asymmetric information in supply chain

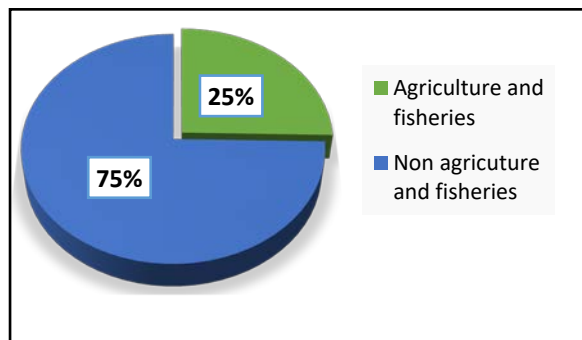
In Figure 6 it can be seen that, for the two-echelon supply chain the issues of asymmetric information caused by price factor [23] - [25], [29] and non-optimal supply chain structure and coordination [56] - [57]; [59], [61] is the largest cause of asymmetric information on the supply chain of two echelons.

For the three-echelon supply chain level, the same as in two supply chain echelons that the main cause of information asymmetry is price [54], [58] and non-optimal structure and coordination in the supply chain [60], [63]. Furthermore, for three echelons relation in the supply chain, it can be seen that studies of asymmetric information in the supply chain especially asymmetric caused by uncertainty demand information have not been widely conducted and it requires future research.

#### 4.2. RQ2: Asymmetric information in supply chain on non-agricultural and non-fishery compare with agriculture and fisheries sectors

Compared to other sectors, the agriculture and fisheries sector has a fairly complex supply chain structure that can include farmers, raw material suppliers, transporters, exporters, importers, retailers, suppliers and companies [1] makes the interaction and sharing of information among them also become increasingly complex. In addition, the agricultural and fishery sectors also have some unpredictable factors that can disrupt demand levels such as weather, temperature and consumer preference [28]. This situation makes the study of asymmetric information in the supply chain in these sectors becomes very important because it gives an empirical impact on the economy considering that some business actors involved in agriculture and fisheries sector are small and medium enterprises (SMEs).

In Figure 7, the results of our study also confirm the research by [98] that many studies on supply chains focus more on large firms than on SMEs. As many as 75% of articles published since 2005-2016 on asymmetric information in the supply chain are conducted in non-agricultural and non-fisheries sectors and 25% of the remaining articles were studying asymmetric information in the supply chain in the agricultural and fishery sectors.

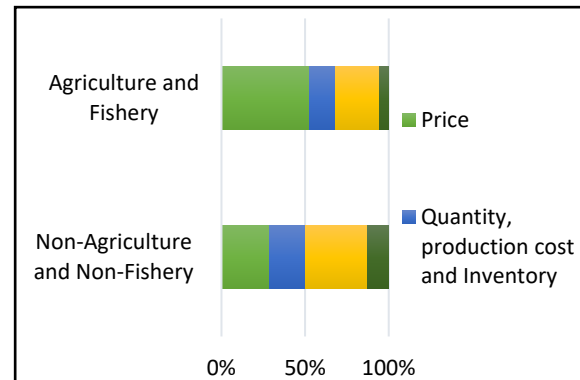


**Figure 7.** Map article based on type of business sectors

In Figure 8, it is seen that for agriculture and fisheries sections some studies are conducted to address asymmetric information in supply chain 50% caused by price transmission, followed by coordination problems and supply chain structure, quantities, production and inventory costs, and demand.

These results suggest that the transmission of prices in the agricultural and fisheries sectors is still a

complicated issue to overcome. When prices fall then the impact of price transmission to farmers is very fast but vice versa when prices rise then the impact on farmers becomes very slow.



**Figure 8.** Relationship between business type and the cause of asymmetric information in supply chain

Ref. [29] argues that this is due to the lack of ability and resources of farmers to obtain information on the upstream side of the supply chain compared to wholesalers, thus making farmers easily to manipulate. For non-agricultural and fisheries sectors, the biggest factors that are the focus of the study of causes of asymmetric information in the supply chain are coordination and supply chain structure [56] - [57], [59] respectively followed by prices [38] - [40], quantity and cost of production [35] and demand [64].

The implication of this result is that in the future there needs of many research that focuses on analyzing and overcome factors that cause asymmetric information in the supply chain in agriculture and fishery sector. Since it's well-known that agriculture and fishery sector give significant impact to the economic growth of a region, considering that most SMEs give a significant multiplier effect on community's welfare.

#### 4.3. RQ3: Research method to mitigate asymmetric information

In Figure 9, it can be seen that studies conducted from 2005 to 2016 on asymmetric information topics in the supply chain show that the method widely used by researchers in order to overcome asymmetric information in the supply chain is by a numerical analysis of 72%, followed by econometric method at 15% then fuzzy approach at 8% and followed by other methods and literature study approach.



Further, in Figure 10 it can be seen that the price as the source of the asymmetric information in the supply chain shows that the numerical analysis method is the most widely used by researchers (13 (25%) of a total of 52 articles using numerical analysis method, followed by econometric method 10 articles (92%) out of a total of 11 articles using the econometrics method approach.

For quantity, cost of production and inventory out of 52 numerical analysis used in observed articles, we found 12 articles (23%) that used the particular method to address the issues, followed by other methods of 2 articles (40%) of the total 5 articles. Coordination and supply chain structure it is seen that numerical analysis also seems to become the most research methods researchers used, where 19 articles (37%) of 52 articles being used to overcome this issue, followed by fuzzy approach method 3 articles (50%) of total 6 articles. Furthermore, for the demand, it was also found that only numerical analysis methods used to handle the uncertainty demand problem.

To mitigate asymmetric information in the supply chain then we found the researchers used several analytical tools based on the type of problem and the solution to be obtained. [56] - [59] used numerical analysis tools to produce results from models built by researchers. This method is widely used because it is suitable for simulating postulates and assumptions that are built in the effort to overcome problems including asymmetric information in the supply chain. Nevertheless, numerical analysis tools also have limitations because it depends heavily on the accuracy of the assumptions being compiled.

To analyze the economic data then, a more suitable analytical tool is the econometric approach, the advantages of this analytical tool are to be used to test the responsiveness and sensitivity of one of the factors to change other factors directly. Some researchers using econometric analysis tools to mitigate asymmetric information in the supply chain are [25], [29] and [37].

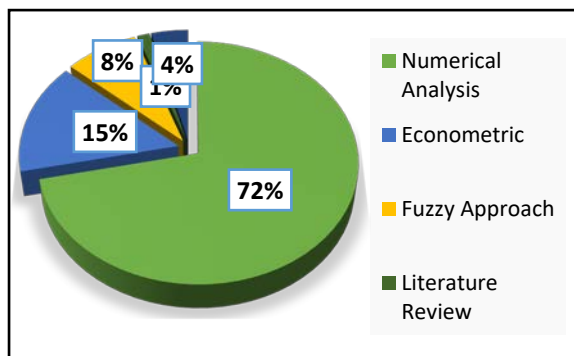


Figure 9. Map articles based on research method

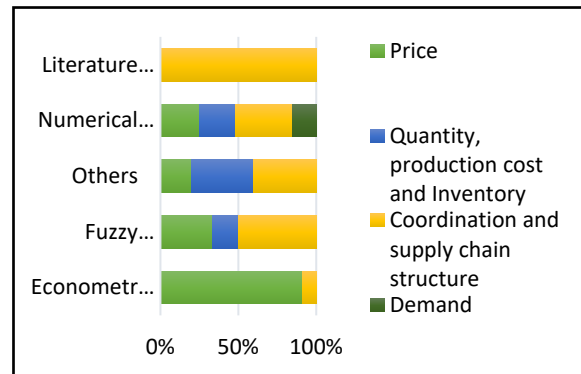


Figure 10. Relationship between research method and the cause of asymmetric information in supply chain

In addition to the above two methods, several approaches can also be found that have been used extensively by researchers in asymmetric information topics in the supply chain are fuzzy approaches [23], [32], [81], then literature studies [1] and several other methods such as case study descriptions [26], qualitative analysis [53].

#### 4.4. RQ4: The cause of asymmetric information in the supply chain

In Figure 11 it can be seen that from articles published since 2005-2016 for asymmetric information topics in the supply chain, the cause of asymmetric information in the supply chain are mostly caused by two factors namely price transmission between actors in the supply chain at 35% (26 articles), followed by coordination problem and supply chain structure at 32% (24 articles) then followed by quantity, production cost and inventory at 20% (15 articles) and demand level 13% (10 articles) respectively.

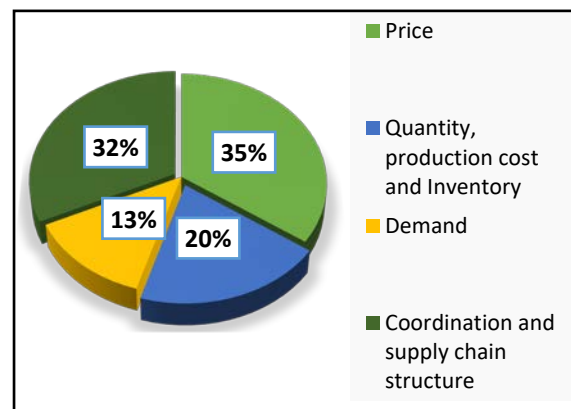
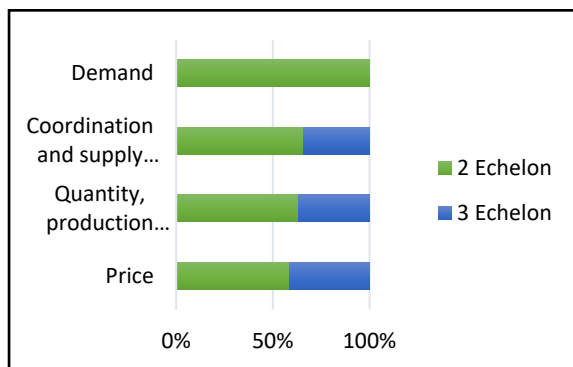


Figure 11. Mapping articles based on cause of asymmetric information in supply chain

In Figure 12a it appears that, given the hierarchy of supply chain relations, based on the two echelon, the uncertainty of demand [45] - [46], becomes the

most likely cause of asymmetric information in the supply chain, followed by price [39] - [40] followed by coordination and supply chain structure [56], [57] and quantity, production and inventory costs [77]. Where on three echelon relation in the supply chain, the common cause of asymmetric information was coordination and supply chain structure [60], [66] and price [54], [58].

The number of studies conducted on the relationship of two echelons in the supply chain is caused by the ease of analyzing the problems that occur in relationships consisting of two parties compared to analyzing the relationship of three echelons that tend to be complex. When there is uncertainty in demand between retailers and companies, both parties will seek to maximize profits by manipulating the information they have, so that under these conditions the influencing factors will tend not to be as complex as the three or echelon relationships.



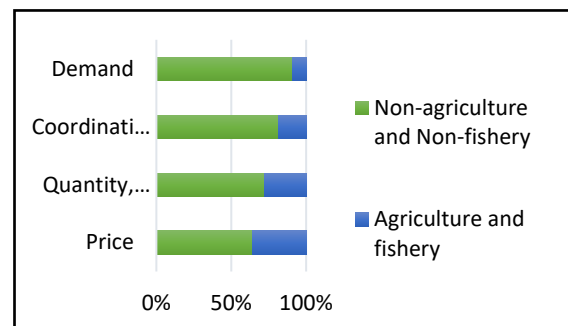
**Figure 12a.** Relationship between the cause of asymmetric information in supply chain and echelon relation

In Figure 12b we can see the relationship between asymmetric information sources in the supply chain and the type of business, it can be seen that most of the problems that occur in asymmetric information in the supply chain occur in non-agricultural and non-fishery sectors. In comparison to the problem of uncertainty, demand factor found that 88% versus 12% between non-agricultural and non-fisheries sectors [64], [73] and agriculture and fisheries sectors [49].

Then for the coordination and supply chain structure, the comparison was 81% for non-agricultural and non-fishery sectors [81], [84] versus 19% for agriculture and fisheries sector [91]. In terms of quantity, production cost and inventory, the proportion of researchers in non-agricultural and non-fishery sectors was 80% [35], [77] versus 20% for agriculture and fisheries [43]. Agriculture and fisheries have a more complex supply chain structure and are still heavily influenced by factors

beyond estimates such as natural factors, thus more complicated to view asymmetric information in the supply chain especially on these sectors.

For transmission price factor, found the same results where 62% for non-agricultural and non-fishery sectors [79], [76], [29] and 38% for agriculture and fisheries [69], [54]. The problem of asymmetric information in the supply chain caused by the price factor is also much studied in the agricultural and fishery sectors because, in addition to being found in many areas, the price factor is also a concern because it is directly related to the welfare of farmers and fishermen.

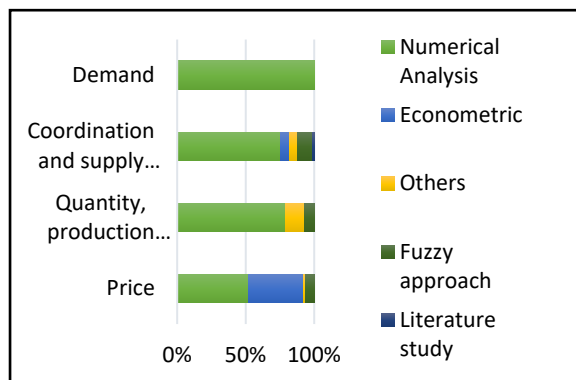


**Figure 12b.** Relationship between the cause of asymmetric information in supply chain and business type

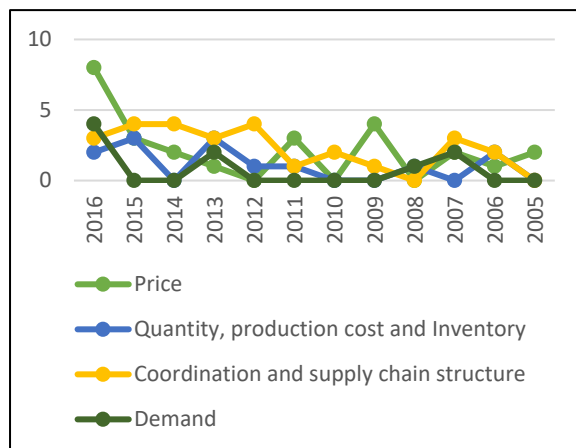
Figure 12c shows that numerical analysis is widely used to overcome asymmetric information in the supply chain especially due to the uncertainty of demand. The demand-related information in the supply chain is information that corresponds to the demand for the product from the retailer to the company or the information of product demand own by the company to the supplier. Non-disclosure of information related to product demand is influenced by the desire to achieve maximum profit by each party in the supply chain. Numerical analysis has the advantage of modeling simulations based on assumptions arranged under conditions of availability of existing information at the demand level in the supply chain, such as studies conducted by [93], [64], and [73].

Similarly, problems with the structure and coordination of the supply chain, where it can be seen that numerical analysis is widely used to simulate and see the results of models built to overcome asymmetric information that occurs due to lack of coordination and less optimal structure in the supply chain, such as studies conducted by [83], [84], [85], [92]. Numerical analysis is also used by most researchers in conditions where asymmetric information is caused by problems in quantity, production cost and inventory of [22]; [75]; [77]; [35]; [42].

For asymmetric problems the information in the supply chain in each echelon caused by the transmission of prices shows that in addition to using a numerical analysis tool 50% of articles published from 2005 to 2016, such as research conducted by [36, [38], [44], [55], [76]. The use of econometric methods is also widely used by researchers to address asymmetric information that occurs as much as 38% such as studies conducted by [50] - [51], [39], [69]. The econometric approach is used to overcome the price transmission in agriculture and fisheries sector, especially with impulse response analysis.



**Figure 12c.** Relationship between the cause of asymmetric information in supply chain and research method



**Figure 13.** Research trend on asymmetric information in supply chain from 2005-2016

As can be seen in Figure 13, until now research on asymmetric information in the supply chain shows that the trend is increasing from 2012 where many types of research are conducted to overcome the problem of price transmission and fluctuation in the supply chain. This is understandable considering the price factor is closely related to the level of profit gained, as well as the demand factor that has increased in the trend of research in 2016. For the coordination and structure of the supply chain has fluctuated in the research trend but is quite stable

since 2012 despite a decrease in 2016 compared to 2015. The similar condition also occurred in the number of production costs and inventories that also fluctuated and in 2016 which have decreased compared to 2015.

#### 4.5. Gap of current research

Table 3 shows that further research should not only focus on supply chains of two-echelon level relationship but on more complex supply chain levels so the solutions can be more applicable and comprehensive in more complex relation.

**Table 3.** Gap of current research and recommendations

Current state	Future research
Focus on two-tier supply chain and less on complex supply chain (three or more echelon)	Future research should focus more on solving the problem of asymmetric information in the supply chain that occurs at more complex supply chain levels, thus providing more applicable results for the business environment
The case studies are still focused on the manufacturing sector rather than the industries that have large multiplier effects on local communities and rural areas such as agriculture and fisheries	The case investigated in the future is also expected in agriculture and fishery sector, considering most parties in this sector are SMEs which also can thrive the local economy if it runs smoothly.
The method used mostly is numerical analysis and other methods used independently of each other	The methods used in subsequent studies should be able to combine several analytical tools so that it will reach the various problems that exist and provide comprehensive solutions
The causes of asymmetric information in the supply chain being that currently studied are prices and coordination factors and supply chain structures	Future studies are expected to focus not only on one issue but on several issues simultaneously such as price issues that can be discussed along with demand and inventory levels so that the resulting solution is expected to provide ideal input for an effort to mitigate asymmetric information in the supply chain.

Future research also still needs to deepen the discussion on the topic of asymmetric information in the supply chain mainly related to the topic of inventory, production cost, supply chain structure, because since the last decade research related to this topic is still very limited. Thus, research that focuses on agriculture and fisheries especially on asymmetric information problem in the supply chain, in general, is very necessary because until now research related to asymmetric information problem in the supply chain in agriculture and fishery sector is still very limited.

#### 4.6. Research limitation and future research agenda

In this study, we use only two databases of the web of science and Scopus, although many studies are also qualified but not indexed in these two databases, especially in repositories from leading campuses worldwide, the literature on the future is expected to expand the scope of the articles used.

Furthermore, the focus of topics discussed are limited to four main parts namely the relationship of echelon level, type of business sector, research method used and the cause of asymmetric information problem in the supply chain. So factor that also affect supply chain and risk of asymmetric information like terrorism [33] and disaster [29] were not be included in this paper therefore, future studies can discuss asymmetric information in the supply chain associated with these factors mentioned.

### 5. Conclusions and Recommendations

From the discussion on the previous section, we found that the research on the mitigation of asymmetric information in supply chain mostly occurs in two echelons supply chain rather than the three echelon. For research method that commonly used to overcome the asymmetric information in the supply chain, the results showed that numerical analysis is widely used by researchers. For the cause of asymmetric information problems, it is found that the problems in the transmission of prices from upstream to downstream in the supply chain are the most researched issues. In addition, the trend of research to date suggests that research trends in price and demand related to asymmetric information in the supply chain are topics that most researchers focused on.

Based on the type of business sector, most studies focus on non-agricultural and non-fisheries sectors, previous research mention the many uncertain factors on agriculture and fishery sector were the reason still lack study on this sector. Thus, consider

the complexity factors in agriculture and fishery sector, future researcher can work collectively with researchers from different background to ease the work and able to provide better result on supply performance problem on these sector.

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